# Distributed Control Paradigms to Enable Resilient Microgrids

**Background and rationale**: Microgrids are small-scale power systems where energy production, consumption, and storage happen in a close physical proximity. They are building blocks of the active distribution network in the emerging smart grid paradigm, and are indispensible to scalable integration of renewable energy sources and electrified transportation fleets. The new power systems landscape will require different control paradigms that can cope with the increasing sensory complexity and co-existence of traditional power plants with new active distribution networks to ensure the system's reliable operation, flexibility, configurability, and scalability. Such paradigm shift is enabled with massive proliferation of power electronics technologies and advanced sensing and communications platforms. Given the mission/safety critical application domains of microgrids, resilient operation and control of such power distribution systems is of paramount value.

Advanced distributed control structures are ideal candidates to enable resilient operation of microgrids. Fully distributed control structures use sparse communication networks, enable plug-and-play functionality, and can be immune to parametric, topological, and dynamical uncertainties. Algorithmic scalability particularly makes them attractive options to accommodate significant aggregation of renewable energy sources and mobiles loads such as electrified transportation fleets. The main objective of this Special Session is to provide timely distributed control solutions for emerging technical challenges in the operational resiliency of microgrids. This Special Session will cover both AC and DC microgrids, small-scale power plants and distributed energy resources (including wind, solar, tidal/wave power, and PHEVs) and storage (including batteries, fuel cells, flywheel, superconducting magnetic, etc.) Submitted articles have to address both the Control and Power reading audience. The topics of interest include, but are not limited to:

- Distributed monitoring, estimation, coordination, and optimization
- Cooperative and competitive control frameworks for small-footprint energy systems
- Controller resiliency and data integrity in response to cyber failure and attacks
- Distributed optimal dispatch and power flow in clusters of microgrids
- Quantifying resiliency metrics in microgrid operation
- Stability and power quality issues for power electronically-interfaced microgrids
- Virtual prototyping and distributed simulation environments for design and development
- Distributed model predictive control for prediction, prevention, and localization
- Cross-layer interplay between physics, control, and communication
- Decentralized hierarchical (primary, secondary, and tertiary) control levels

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